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# Is the rising cost of education uniform across all of Australia's Capital Cities?

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## Abstract

This paper compares and contrasts the aggregate cost of education in Australia with the cost of education in each of its eight capital cities surveyed in the Consumer Price Index. It appears that education is becoming a relatively more expensive item among Australian households with rising substantial differences across various geographical areas. Over the last three decades on average the Australian economy witnessed an overall annual inflation rate of 4.2 per cent, whereas the growth of education cost was 7.3 per cent per annum. It is interesting to note that the rising cost of education was not the same across all capital cities. This paper shows that in Adelaide, Brisbane and Sydney the cost of education grew more than Darwin, Canberra and Melbourne. Our results clearly indicate that the introduction of the Higher Education Contribution Scheme (HECS) in 1989, the Goods and Services Tax (GST) in 2000 and the Reserve Bank of Australia's (RBA) inflation-targeting policy launched in 1993 each have significantly contributed to changes in the real cost of education over our sample period (1982q1-2009q4).



## Keywords

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# Is the Rising Cost of Education Uniform Across All of Australia's Capital Cities?

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# Is the Rising Cost of Education Uniform Across All of Australia's Capital Cities?

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This paper compares and contrasts the aggregate cost of education in Australia with the cost of education in each of its eight capital cities surveyed in the Consumer Price Index. It appears that education is becoming a relatively more expensive item among Australian households with rising substantial differences across various geographical areas. Over the last three decades on average the Australian economy witnessed an overall annual inflation rate of 4.2 per cent, whereas the growth of education cost was 7.3 per cent per annum. It is interesting to note that the rising cost of education was not the same across all capital cities. This paper shows that in Adelaide, Brisbane and Sydney the cost of education grew more than Darwin, Canberra and Melbourne. Our results clearly indicate that the introduction of the Higher Education Contribution Scheme (HECS) in 1989, the Goods and Services Tax (GST) in 2000 and the Reserve Bank of Australia's (RBA) inflation-targeting policy launched in 1993 each have significantly contributed to changes in the real cost of education over our sample period (1982q1-2009q4). JEL Codes: E31; H52; I21.

## 1. Introduction

Chou (2003, p.397) echoed the importance of human capital as a major determinant of economic growth and productivity by arguing that "42 per cent of Australian growth between 1960 and 2000 is attributable to the rise in educational attainment". Valadkhani, Worthington and Layton (2005) found that compared to the price of other goods and services, the cost of education in Australia, the UK and the US has been increasing at an alarming rate. Of course, a well educated person can benefit from education by generating higher personal income in the future and so we do not take issue in this paper with the role of the private funding of educational. The indefinite provision of "free" education by government is neither equitable nor sustainable in the future. However, one should recognize that students studying in areas generating significant social benefits-but perhaps associated with relatively low market income- should be supported by the provision of income-contingent loans as well as government direct funding for at least some portion of their study cost.

Based on previous purchasing power parity studies, services are often more expensive in industrialised countries than in developing countries (see, *inter alia*, Dowrick, 2001, and OECD, 2001) and so one might expect a labour-intensive service like education to be increasing in relative price as the country grows. Related to this same issue, Baumol (1997) asserts that the increasing cost of labour-intensive industries, such as the arts, health care, and education, appears to be quite normal. On average price rises in service industries can thus be expected to be relatively higher than the inflation rate for the economy as a whole.

The increasing education expenditure can be attributed to "the low productivity of labour-intensive government activities compared with the relatively capital-intensive private sector" (Fordham, 2003, p.574). According to Gundlach and Wöβmann (2001), the price of schooling rose more than the price of other labour-intensive services in 1980 to 1994 for six East Asian countries. They related the declining relative productivity of schooling to the increasing price of schooling. The declining productivity of schooling in East Asian countries was largely explained by a substantial fall in the pupil-teacher ratio (Gundlach and Wöβmann, 2001).

Due to its labour intensive nature, services such as education probably are quite normal to become more expensive for an advanced country such as Australia. However, it is important to investigate why the cost of education exhibits different patterns in various capital cities through time and what the possible causes of this phenomenon are. The major objectives of this paper are thus as follows: (i) measure the extent to which the cost of education has been different in various capital cities of Australia; and (ii) determine the interplay between the overall cost of education and the cost of education in each city, which undoubtedly will have implications for the decision makers at the corresponding state and federal levels.

The remainder of this paper is structured as follows: Section 2 discusses the description of the data and various important issues regarding the cost of education in Australia. Section 3 presents the theoretical framework of the paper by capturing the long- and short-run relationships between the aggregate real cost of education and the associated education cost in Australian capital cities. We incorporate the effects of the introduction of the Higher Education Contribution Scheme (HECS) in 1989, the Goods and Services Tax (GST) in 2000 and the Reserve Bank of Australia's (RBA) inflation targeting policy in 1993 into such relationships using the Engle and Granger (1987) methodology. Section 4 presents our empirical results and raises several important policy issues as to why the rising cost of education varies from one city to another. The final section provides some brief concluding remarks.

## 2. The Data

Australian Bureau of Statistics (ABS, 2010) has disaggregated the education sub-group of the CPI into three main sub-categories, viz. Pre-school and Primary education; Secondary education; and Tertiary education. The published data on these sub-groups are available only from June quarter 2000 to December quarter 2009. Table 1 presents the annual growth rate of each education sub-group of the CPI during the period June 2000-December 2009. It is obvious that in this period while the cost of tertiary education has been increasing by 3.76 per cent per annum for Australia as a whole, the corresponding growth rates in both preschool and primary education and secondary education were above 5.94 per cent and 6.85 per cent, respectively.

**[Table 1 about here]**

Table 1 also provides a disaggregated picture of the sources of various components of the cost of education using all available data by the ABS (2010). Based on Table 1, except in Darwin

and Perth, it appears that the rise in the cost of secondary education in all capital cities is greater than the cost of preschool and primary education and the tertiary education. Valadkhani, Worthington and Layton (2005) found that the rising number of students enrolled at non-governmental secondary and primary schools and the introduction of the Higher Education Contribution Scheme (HECS) have been the two major determinants of the rising cost of education. It should be recognized that total enrolments at both primary and secondary private schools exhibited an upward trajectory by about 1.7 per cent per annum over the 15 years, compared with a meager rise of 0.18 per cent annually for government schools (ABS, 2003). Undoubtedly this may reflect households' choices in relation to the provision of a higher quality education for their children in private schools and we believe government should not be too concerned about it. Valadkhani, Worthington and Layton (2005, p.101) conclude that "to a large extent, and on a relative basis, the increasing cost of education is attributable to the rising expenses in preschool and primary education and secondary education. A small weight assigned (around 4 per cent in 2009) to education in the computation of the CPI can explain the meager average contribution of the three components of the Education sub-group of the CPI". They also found that the rise in the cost of Education and Alcohol and Tobacco was: (a) more than the other nine CPI sub-groups, (b) almost twice as much as Australia's headline inflation in both pre- and post-inflation targeting eras. One may not be concerned with the rising price of Alcohol and Tobacco because it can discourage the excessive consumption of these products. But the overall long-run rise and significant city differentials in the cost of education are obvious causes of concern.

**[Figure 1 about here]**

Figure 1 presents a comparison between the aggregate cost of education in Australia as a whole and the cost of education in each of the eight capital cities during the period 1982Q1-2009Q3 as well as the relationship between the aggregate cost of education and the overall CPI. A cursory look at this Figure reveals several interesting findings: (i) up to 1989, when the HECS was introduced, the overall cost of education in Australia was below the CPI; (ii) since the introduction of inflation targeting in 1993 the relative cost of education (over and above the CPI) in Adelaide and Brisbane have been greater than the aggregate cost of education and the reverse is almost true in the context of Darwin and Melbourne; (iii) it appears that in the post-GST period (i.e. 2000-2009), the relative cost of education in Canberra and Perth have been less than the aggregate cost of education. Therefore, one can conclude that the cost of education relative to the CPI has not been the same across all capital cities in Australia and, *inter alia*, the HECS, the GST and the RBA (Reserve Bank of Australia) inflation targeting policy have all contributed to the systematic divergence and/or convergence in the graphs reported in Figure 1.

## 3. Theoretical Framework

Based on the above descriptive analysis, we can now hypothesize that the relationship between the aggregate cost of education in Australia as a whole and the cost of education in each of the eight Australian capital cities can be affected by at least three factors: (i) the introduction of HECS in 1989; (ii) the introduction of inflation targeting by the RBA in 1993;

and (iii) the implementation of the GST in 2000. Thus, the following specification is used to represent the long-run relationship between the aggregate real cost of education and the city-specific real cost of education after allowing the above three phenomena affect the slope coefficient $\beta_i$ :

$$Ln\left(\frac{P_i^E}{P}\right)_t = \alpha_i + \beta_i Ln\left(\frac{\overline{P}^E}{P}\right)_t + \gamma_i Ln\left(\frac{\overline{P}^E}{P}\right)_t \cdot HECS_t + \lambda_i Ln\left(\frac{\overline{P}^E}{P}\right)_t \cdot IT_t + \varphi_i Ln\left(\frac{\overline{P}^E}{P}\right)_t \cdot GST_t + e_{it} \quad (1)$$

Where:

$P_i^E$ = the cost of education index (1996=100) in capital city *i*,

$P$ =the consumer price index,

$\overline{P}^E$ = the aggregated cost of education in Australia as a whole,

*HECS*=1 in the post-HECS period (i.e.1989-2009) and zero otherwise,
*IT*=1 in the inflation targeting era (i.e.1993-2009) and zero otherwise,
*GST*=1 in the post-GST period (i.e. 2000-2009) and zero otherwise,
*Ln*= the natural logarithm,
$e_{it}$ = the white noise error term for the $i^{th}$ capital city in period *t*.

We need to examine the time series properties of the data before estimating equation (1). This is important because the use of non-stationary data in the absence of the series being cointegrated can result in obtaining spurious regression results. In addition to the Kwiatskowski-Phillips-Schmidt-Shin (KPSS) test, we have done the Zivot and Andrews (1992) and Lee and Strazicich (2003) tests, ensuring that the unit root test results are not biased towards the erroneous non-rejection of the non-stationarity hypothesis. Due to space limitations, the test results are not provided in this paper but they are available from the authors upon request. According to the test results, all price variables used in equation (1) are I(1), indicating that they become stationary after first differencing. Given that all the variables are I(1), the Engle-Granger two-step procedure can now be used to examine if this equation represents a long-term relationship. We expect that $\beta_1$ to be around unity with possible three shifts associated with the introduction of HECS, the GST and the RBA's inflation targeting policy.

If all the variables in equation (1) are I(1) and the resulting residuals are I(0), according to Engle and Granger (1987), it can then be stated that there exists a corresponding error-correction mechanism (ECM or $e_{-1}$) model of the following form:

$$\Delta Ln\left(\frac{P_i^E}{P}\right)_t = \eta_i + \sum_{j=0}^{k=4} \delta_{ij} \Delta Ln\left(\frac{\overline{P}^E}{P}\right)_{t-j} + \theta_i e_{it-1} + \sum_{j=1}^{q=3} \mu_j Q_{jt} + \nu_t \quad (2)$$

Where:

$\delta_{ij}$ =the estimated short-term coefficients;

$\theta_i$=the estimated feedback effect or the speed of adjustment of the $i^{th}$ city, whereby short-term dynamics converge to the long-term equilibrium path indicated in equation (1);

$\mu_j s$ =the estimated coefficients of three seasonal dummy variables, where $Q_1$=1 in the first quarter, otherwise zero, $Q_2$=1 in the second and otherwise zero and $Q_3$=1 in the third quarter and otherwise zero, the fourth quarter is assumed to represent the benchmark quarter;

$v_t$ is the white noise disturbance term;

$e_i$ or ECM is obtained from equation (1); and
$\Delta$ indicates the first-difference operator.

We utilized the general-to-specific methodology to exclude the insignificant variables in equation (2) using a battery of maximum likelihood tests. By imposing joint-zero restrictions on explanatory variables in the unrestricted (general) model, we have obtained the most parsimonious and robust equation in the estimation process as discussed in the next section.

## 4. Empirical Results

The empirical econometric results for equation (1) are presented in Table 2 using the OLS estimation method and quarterly time series data from 1986Q1 to 2009Q4. As seen from Table 2, all the estimated coefficients are statistically significant at the 5 per cent significance level or better, and have the expected theoretical signs. The estimated equations also perform extremely well in terms of goodness-of-fit statistics. The adjusted $R^2$ varies from 0.999 for Melbourne to 0.915 for Darwin and all of the overall $F$ tests are rejected at the 1 per cent level.

**[Tables 2 and 3 about here]**

Based on these results, the effect of one per cent increase in the real aggregate cost of education (*PE/P*) on the education cost in each capital city varies in different time periods due to the significance of the three slope dummy variables. For example, in 2009 one per cent rise in *Ln*(*PE/P)* could increase the cost of education more than unity in three capital cities (*i.e.* in Adelaide by 1.28% in Brisbane by 1.12% and Sydney by 1.05%) and less than unity in the other five cities, particularly in Darwin (0.32%) and Canberra (0.87%), which are found to be the lowest. Therefore, it can be concluded that in the long-run while in Adelaide, Brisbane and Sydney the real cost of education (over and above the CPI) is increasing more than the national average, the opposite is the case for Darwin and Canberra.

Since the estimated residuals are all I(0), we could argue that after capturing the breaks associated with the HECS, the GST and the RBA's inflation-targeting policy, our two series, *i.e.* $\left(\overline{P}^E / P\right)$ and $\left(P_i^E / P\right)$, for all eight cities are cointegrated in tandem. One can graphically observe these long-run relationships from Figure 1 for all cities, with the only exception being the case of Darwin's graph which the deviation seems quite persistent.

Table 3 presents the estimation results of the short-run dynamics for each of the eight capital cities as indicated in equation (2) or the second stage of the Engle-Granger methodology. All the estimated equations generate white noise and I(0) residuals and pass all the reported diagnostic tests in Table 3 with an adjusted $R^2$ ranging from 0.682 (Darwin) to 0.978 (Sydney). Once again $\overline{R}^2$ is very high for all capital cities (minimum 0.884) except for Darwin. As theoretically expected, the feedback coefficients for all cities are negative and mostly statistically significant (6 out of 8 coefficients) and of a very sluggish nature. The Wald test $H_0 : \delta_i = 1$ is rejected for all cities except for Sydney and Hobart. Due to the use of

seasonally-unadjusted data, we have also included three seasonal dummy variables to capture the seasonal effects. The results show that $Q_1$ is statistically significant for four out of eight cities.

This paper raises a number of important policy questions: why should the cost of education exhibit different trends in different cities while various capital cities in aggregate are supposed to provide homogeneous products? Are these differences calling for an inquiry into the cost of education in cities such Adelaide (the most expensive city) and Darwin (the cheapest one)? Is there any evidence that the higher cost of education in some cities have had an impact on the quantity/quality consumed? As can be seen this research raises various questions which could be subject to future research.

## 5. Concluding Remarks

The present paper employs the quarterly time series data 1982Q1-2009Q4 to examine how fast the cost of education is rising in each of Australia's eight capital cities. Overall, the education cost has been increasing faster than inflation and paradoxically for the most part even faster than leading economic 'sins' (Alcohol and Tobacco). This phenomenon reflects Australian households' choices concerning education in relation to the choice between private and public primary and secondary education or tertiary courses, institutions and their different fee structures. Based on our results, it appears that the magnitude of the rise in the cost and affordability of education is more pronounced in Adelaide, Brisbane, Sydney and Hobart than those of other capital cities. It is interesting to note that the cost of education in Darwin (and to a lesser extent Canberra) is at odds with the rest of Australia, making education cheaper on a relative basis. This opens up a set of new questions which could be the interesting topics on the agenda for future research.

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**Biographical notes**

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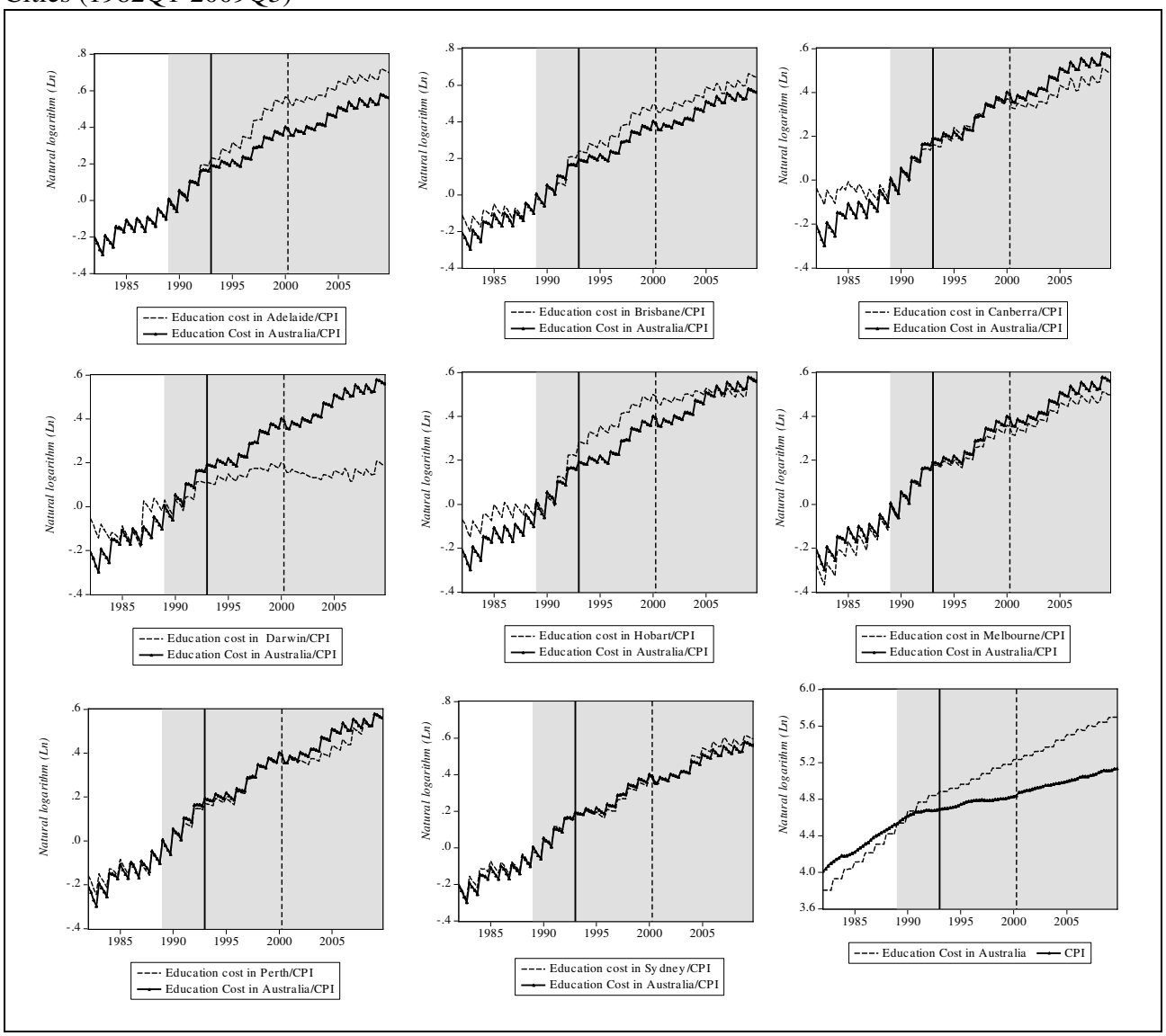
**Table 1: Annual Average Growth of Education Cost (2000-2009)**

| City | Annual growth rate of education cost (%) | | | |
|---|---|---|---|---|
| | Total Education | Preschool & primary | Secondary | Tertiary |
| Australia (averaged across 8 capital cities) | 5.28 | 5.94 | 6.85 | 3.76 |
| Adelaide | 4.95 | 6.06 | 6.58 | 2.77 |
| Brisbane | 5.12 | 6.77 | 7.01 | 3.41 |
| Canberra | 4.78 | 4.85 | 7.11 | 2.87 |
| Darwin | 3.26 | 4.74 | 3.83 | 2.79 |
| Hobart | 4.05 | 3.19 | 4.86 | 3.59 |
| Melbourne | 5.00 | 5.94 | 6.44 | 3.18 |
| Perth | 5.19 | 7.66 | 6.54 | 3.20 |
| Sydney | 5.82 | 5.10 | 7.51 | 4.88 |

**Source:** Australian Bureau of Statistics (2003).

**Figure 1:** The Relative Cost of Education and the Consumer Price Index in Australian Capital Cities (1982Q1-2009Q3)




**Source:** Australian Bureau of Statistics (2003).
**Notes:** (a) The shaded area shows the post-HECS period (1989-2009). (b) The solid vertical line in 1993 indicates the introduction of inflation targeting by the RBA. (c) The vertical dotted line in 2000Q2 marks the introduction of the GST by the Australian government.

**Table 2:** The long-run relationship between the aggregate cost of education and the cost in each capital city (1982q1-2009q4)

| City (1) | *Intercept (2)* | *$Ln(PE/P)_t$ (3)* | *$D93*Ln(PE/P)_t$ (4)* | *$HECS*Ln(PE/P)_t$ (5)* | *$GST*Ln(PE/P)_t$ (6)* | *$Ln(PE/P)_t$ *D9205 (7)* | $\overline{R}^2$ (8) | *Elasticity in 2009* *(9)=(3)+(4)+(5)+(6)* | *F*-statistic | Order of integration of residuals |
|---|---|---|---|---|---|---|---|---|---|---|
| Adelaide | -0.004 | 1.270** | 0.378** | | -0.124** | | 0.995 | 1.281 | 6980** | *I(0)* |
| Brisbane | 0.020** | 0.802** | 0.430** | | -0.109** | | 0.994 | 1.123 | 5934** | *I(0)* |
| Canberra | -0.005 | 0.313** | | 0.686** | -0.133** | | 0.993 | 0.866 | 5019** | *I(0)* |
| Darwin | 0.003** | 0.549** | | | -0.233** | | 0.915 | 0.316 | 602** | *I(0)* |
| Hobart | 0.033** | 0.560** | 0.530** | -0.177** | | 0.197** | 0.990 | 0.913 | 2838** | *I(0)* |
| Melbourne | 0.000 | 1.313** | -0.108 | -0.308** | | | 0.999 | 0.897 | 34681** | *I(0)* |
| Perth | -0.014 | 0.782** | 0.062** | 0.167** | -0.059** | | 0.993 | 0.952 | 4110** | *I(0)* |
| Sydney | -0.001 | 0.855** | -0.058* | 0.139** | 0.118** | | 0.997 | 1.054 | 9810** | *I(0)* |

**Notes:** ** and * indicate that the corresponding null hypothesis is rejected at least at the 1 and 5 per cent levels of significance.

**Table 3:** Short-run dynamic relationship between the aggregate cost of education and the cost of education in each capital city (1982q1-2009q4)

| Variable/Statistics | Estimated Coefficients | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Adelaide | Brisbane | Canberra | Darwin | Hobart | Melbourne | Perth | Sydney |
| *Intercept* | -0.0013 | -0.0058** | -0.0032** | -0.0029 | -0.0006 | 0.0014** | -0.0002 | 0.0002 |
| $\Delta Ln(PE/P)$ | 0.8872** | 0.7945** | 0.6725** | 0.7268** | 0.8936** | 1.1241** | 0.9539** | 1.0028** |
| $ECM_{t-1}$ | -0.0635* | -0.0850* | -0.0612 | -0.1036** | -0.0255* | -0.0763 | -0.0682* | -0.1119** |
| *Q1* | 0.0132** | 0.0154** | 0.0132* | | | -0.0090** | | |
| *HECS* | | 0.0045* | | | | | | |
| Wald test $H_0 : \delta_i = 1$ | F(1,107)=7.2** | F(1,106)=10.7** | F(1,107)=15.2** | F(1,108)=30.8** | F(1,108)=3.0 | F(1,107)=22.6** | F(1,108)=5.6* | F(1,108)=0.01 |
| $\overline{R}^2$ | 0.966 | 0.921 | 0.927 | 0.682 | 0.884 | 0.987 | 0.957 | 0.978 |
| *F*-statistic | 1033** | 320** | 466** | 119** | 421** | 2763** | 1219** | 2490** |
| DW | 1.91 | 1.88 | 1.85 | 1.91 | 1.94 | 1.79 | 1.94 | 1.96 |
| Order of integration of residuals | *I(0)* | *I(0)* | *I(0)* | *I(0)* | *I(0)* | *I(0)* | *I(0)* | *I(0)* |
| F-statistic | 1033 | 319.5409 | | | | | | |
| Ramsey RESET Test | F(1,106)=1.39 | F(1.105)=0.255 | F(1,106)=0.626 | F(1,107)=0.640 | F(1,107)=1.64 | F(1,106)=1.14 | F(1,107)=2.06 | F(1,107)=0.043 |
| Breusch-Godfrey Serial Correlation LM Test | F(2,105)=0.168 | F(2,104)=0.591 | F(1,105)=0.367 | F(2,106)=0.373 | F(2,106)=0.160 | F(2,105)=0.685 | F(2,106)=1.67 | F(2,106)=0.101 |
| Heteroskedasticity ARCH test | F(1,108)=1.153 | F(1,108)=0.023 | F(1,108)=2.488* | F(1,108)=0.006 | F(1,108)=1.202 | F(1,108)=0.619 | F(1,108)=1.26 | F(1,108)=0.521 |

**Notes:** ** and * indicate that the corresponding null hypothesis is rejected at least at the 1 and 5 per cent levels of significance.